

(19)

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(11)

EP 0 891 001 A1

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:

13.01.1999 Bulletin 1999/02

(51) Int. Cl.<sup>6</sup>: H01Q 1/08

(21) Application number: 98114646.7

(22) Date of filing: 19.05.1995

(84) Designated Contracting States:  
DE ES FR GB IT PT

(30) Priority: 07.09.1994 IT VI940131

(62) Document number(s) of the earlier application(s) in  
accordance with Art. 76 EPC:  
95107688.4 / 0 701 295

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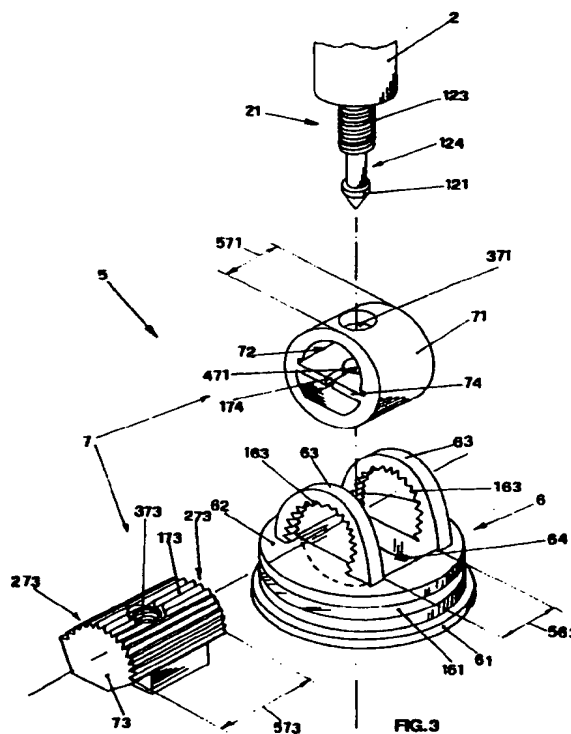
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### Remarks:

This application was filed on 04 - 08 - 1998 as a  
divisional application to the application mentioned  
under INID code 62.

### (54) Anti-theft antenna

(57) The invention discloses an antenna comprising a rod (2) suitable for receiving radio-frequency signals and connected to a joint element (5) belonging to a support base (3) of the antenna and also suitable for being constrained to a support surface (4). Said rod (2) is provided with a terminal element (21) unidirectionally insertable in a through hole (471) obtained in an elastic body belonging to said joint element (5).



## Description

The invention concerns an antenna particularly suited to be applied to motor vehicles.

It is known that antennas for motor vehicles substantially consist of a base applied to the body of the car and supporting a rod which constitutes the active element of the antenna.

In the known applications the rod of the antenna can be fixed or it can be oriented with respect to the base and it is connected to the base itself by means of removable connection means, for example screws, pins and the like. Therefore, one of the drawbacks of the known antennas is represented by the fact that unauthorized persons can remove the antenna rod from the relevant support with rather simple operations, even if this requires the use of appropriate tools.

The present invention is aimed at eliminating the inconvenience described above through the implementation of an antenna particularly suitable for being installed on motor vehicles that should also have antitheft features, that is, features suitable for preventing the removal of the rod from the support base. Another aim of the invention is the implementation of an antenna in which said antitheft features can be provided both on the version with adjustable inclination and on the fixed version.

The goals mentioned above have been achieved through the implementation of an antenna particularly suitable for being installed on motor vehicles, which, according to the main claim, comprises a rod that is suitable for receiving radio-frequency signals and can be connected to a joint element belonging to a support base of the antenna itself and also suitable for being constrained to a support surface and is characterized in that said rod is provided with a terminal element that can be unidirectionally inserted in a through hole obtained in an elastic body belonging to said joint element.

According to a preferred embodiment of the invention described below, the antenna object of the invention, provided with antitheft features, can also be oriented and its joint element, which belongs to the support base and to which the rod is fixed, is constituted by a ball-and-socket joint.

The goals described above and any other detail will be better highlighted in the following description, with reference to the enclosed drawings, wherein:

- Fig. 1 shows the antenna according to the invention;
- Fig. 2 is an exploded view of the supporting base, the rod and the ball-and-socket joint which compose the antenna according to the invention represented in Fig. 1;
- Fig. 3 is an axonometric exploded view of the detail of the ball-and-socket joint represented in Fig. 2;
- Fig. 4 is a front view of the ball-and-socket joint of

Fig. 3 already assembled;

- Fig. 5 shows the ball-and-socket joint of Fig. 4 in a cutaway representation according to a vertical mid-plane, while it is being assembled to the rod of the antenna;
- Fig. 6 shows the ball-and-socket joint represented in Fig. 5 once the assembly with the rod has been completed;
- Fig. 7 shows the ball-and-socket joint of Fig. 6 with the rod applied to it, while it is being removed;
- Fig. 8 shows the ball-and-socket joint of Fig. 6 while the rod is being oriented;
- Fig. 9 shows the detail of the connection of the ball-and-socket joint to the base of the antenna;
- Fig. 10 shows a different embodiment of the ball-and-socket joint.

As can be observed in Fig. 1, the antenna object of the invention, indicated as a whole with 1, comprises a rod 2 connected to a supporting base 3 applied to a supporting surface 4 consisting of the body of a car, for instance.

In the application described below the joint element 5 is a ball-and-socket joint, so that the rod 2 can be oriented. However, it is obvious that in a different embodiment the joint element may also be fixed.

Said ball-and-socket joint, indicated as a whole with 5, visible in better detail in the exploded views of Fig. 2 and Fig. 3, which is composed by a first ball-and-socket joint element 6, connected to the base 3, which co-operates with a second ball-and-socket joint element 7 connected to the rod 2. Said first ball-and-socket joint element 6 is applied to said base 3 through first connecting means which consist of an annular area 61 arranged at the extremity of the body 62 of said first ball-and-socket joint element 6, said area snap-coupling with a corresponding annular duct 31 visible in Fig. 9 and obtained in the base 3 of the antenna itself. Said first ball-and-socket joint element 6 is made of conductive material and presents a pair of rings 63 co-axial with one another and placed at a distance from each other, which are preferably obtained from a single block in the body 62 of the element itself, and a housing 64, having an essentially circular profile, being defined between said two rings. Said second ball-and-socket joint element 7 comprises, as can be observed in Fig. 3, an insulating reel 71 having an essentially circular profile, which presents a seat 72 within which, as can be observed in better detail in Fig. 4, a toothed element 73 made of conductive material and having a substantially circular profile is inserted. In particular, said seat 72 is defined inside said insulating reel 71 by the presence of an elastic body consisting of a plate 74 having a through hole 471 communicating with a notch 174 suited to make it elastic. Moreover, said insulating reel 71 has an axial length 571 equivalent to the axial distance 563 between the rings 63, so that said insulating reel 71 can be lodged in the housing 64 provided between said

rings 63. Said toothed element 73 belonging to said second ball-and-socket joint element 7 and said coaxial rings 63 belonging to said first ball-and-socket joint element 6 are equipped with contrasting means which comprise an outer toothing 173 obtained in said toothed element 73 and an inner toothing 163 obtained in each of said rings 63, wherein said toothings present profiles connected with one another and such as to be able to reciprocally co-operate whenever said first and second elements are joined together. It can be observed in particular in Fig. 3 that the toothed element 73 has an axial length 573 which is bigger than the axial length 571 of the insulating reel 71, so that when said toothed element 73 is lodged in the seat 72 of said insulating reel 71, once the latter has been inserted in the housing 64, its ends 273 protruding from the reel 71 co-operate with the coaxial rings 63 by means of their corresponding toothings, as can be observed in Fig. 4. It can be also observed that said toothed element 73 and said insulating reel 71 are equipped with second means for the connection to the rod 2 of the antenna which consist of a through hole 371 drilled in the body of said insulating reel 71 which is positioned coaxially with a corresponding threaded through hole 373 drilled in the body of said toothed element 73; a non-threaded through hole 471 is provided at the center of the partition 74.

According to the invention, the rod 2 is provided with a terminal element 21 that can be unidirectionally inserted in the through hole 471 obtained in the elastic partition 74.

The terminal element 21 comprises a substantially cylindrical body mainly developed in the axial direction and having a threaded area 123 at the end of the rod 2 and a non-threaded area 124 with reduced diameter positioned at the end of said threaded area 123, provided with a conical terminal part 121.

The toothed element 73 rests on the elastic partition 74, which yields elastically when the terminal element 21 of the rod 2 unidirectionally pushes the toothed element 73 against the elastic partition 74 itself. In this way the conical terminal part 121 fits in the through hole 471 of the partition 74 and the non-threaded area 124 and threaded area 123 couple in the holes 371 and 373 respectively, said holes constituting the already mentioned second connection means.

In particular, it can be observed in fig. 5 that when the threaded area 123 is coupled to the threaded hole 373 of the toothed element 73, the conical terminal part 121 forces against the hole 471 of the elastic partition 74, thus deforming its ends 574. When the ends 574 are completely deformed, the conical terminal part 121 enters the hole 471 and the non-threaded area 124 of the terminal element 21 couples to the hole 471 itself until the rod 2 is positioned as shown in fig. 6.

In this way the antenna has the required antitheft features, since the rod 2 cannot be removed from the support 3 to which it is applied.

In fact, as shown in fig. 7, if the rod 2 is unscrewed

from the threaded through hole 373 and is then lifted according to the vertical direction 221, the conical terminal part 121 strikes against the ends 574 of the elastic partition 74. The latter cannot be deformed according to the direction 221, since the bending of its ends 574 is prevented by the presence of the toothed element 73, which is rigid and undeformable. Therefore, the hole 471 cannot be enlarged, which prevents the passage of the conical terminal part 121 and the removal of the rod 2.

When the rod 2 is coupled with the ball-and-socket joint element 5, the contact of the toothings 173 and 163 with one another permits a stick-slip rotation of the rod 2, as can be observed in Fig. 8, following any of the directions represented by the arrow 120 which are made possible by the rotation of the insulating reel 71 inside the housing 64 within which it is inserted.

The rod 2 can therefore be oriented in different directions in any sense on the drawing plane indicated by the arrow 120.

If it is necessary to lock the rod in any of the reached angular positions, it will suffice to tighten the rod 2 into the threaded hole 373, so as to force the toothed element 73 against the co-axial rings 63, thus creating an interference between the respective toothings. This yields the advantage that the antenna can be pointed in the best position, whether it is used as an antenna for the reception of radio broadcastings or as an antenna for the two-way transmission by radiophone.

To change the inclination of the antenna, it is sufficient to push the rod 2 against the insulating reel 71, so that the elastic partition 74 lowers together with the toothed element 73 that rests on it. In this way the teeth 173 of the toothed element 73 are released from the coupling with the relevant teeth 163 of the rings 63, thus making it possible to change the direction of the rod 2.

Once the new position has been reached, the elastic recovery of the partition 74 restores the meshing of the toothings, in such a way as to keep the rod 2 fixed in the reached direction.

In Fig. 9, which represents the detail of the connection between said first ball-and-socket joint element 6 and the base of the antenna 3, it can be observed that the watertight seal in the area 21 which is below said first ball-and-socket joint element 6 and, therefore, in contact with the supporting surface 4 of the antenna, is ensured by the presence of a gasket 131, preferably an OR, which is lodged inside an annular groove 161 obtained in the body 62 of said second ball-and-socket joint element 6. A different embodiment of the ball-and-socket joint element of the antenna is represented in Fig. 10, wherein it can be observed that said ball-and-socket joint 50 presents said second ball-and-socket joint element, indicated as a whole with 60, wherein the insulating reel 710 is equipped with an elastic partition 740 which, instead of being obtained in a single piece with the body of the reel 710, is added to it since it is lodged inside guides 741 obtained in the body of the

reel itself which receive said elastic partition 740. According to what has been said, it is understood that the antenna according to the invention achieves all the set goals. During the manufacturing process the antenna may undergo some modifications concerning its shape, its length, its dimensions in general. 5

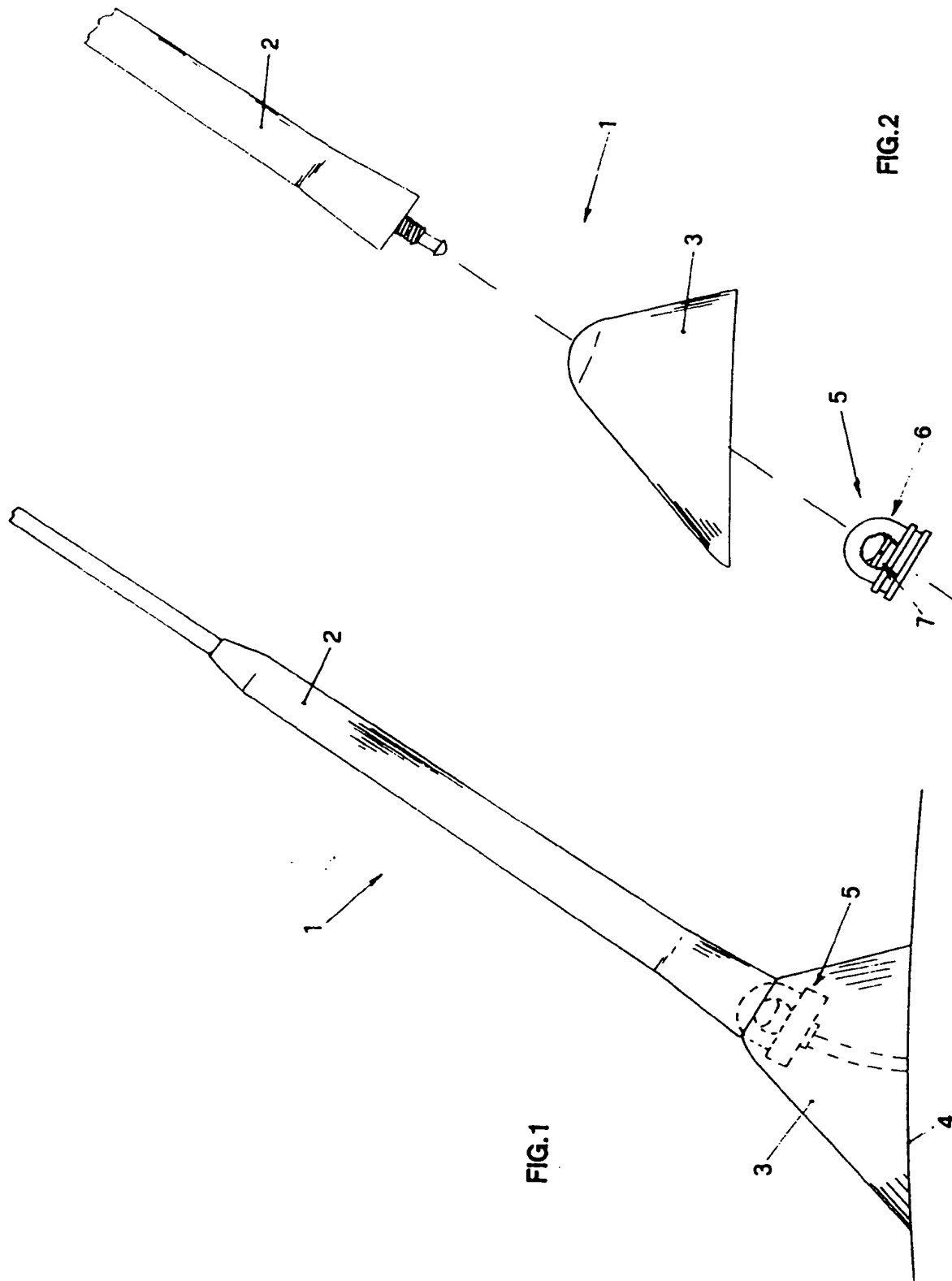
The shape and dimensions of the ball-and-socket joint which connects the rod to its base may change, as may the shape and dimensions of the contrasting elements of the elements which compose the ball-and-socket joint. In particular, with regard to the elements which compose the ball-and-socket joint, these may acquire any shape which, rather than being essentially cylindrical as has been described, it can be spheric so as to permit the orientation of the rod of the antenna in space rather than on the surface. However, it is to be understood that all said possible modifications will fall within the spirit and scope of the present invention. 10 15

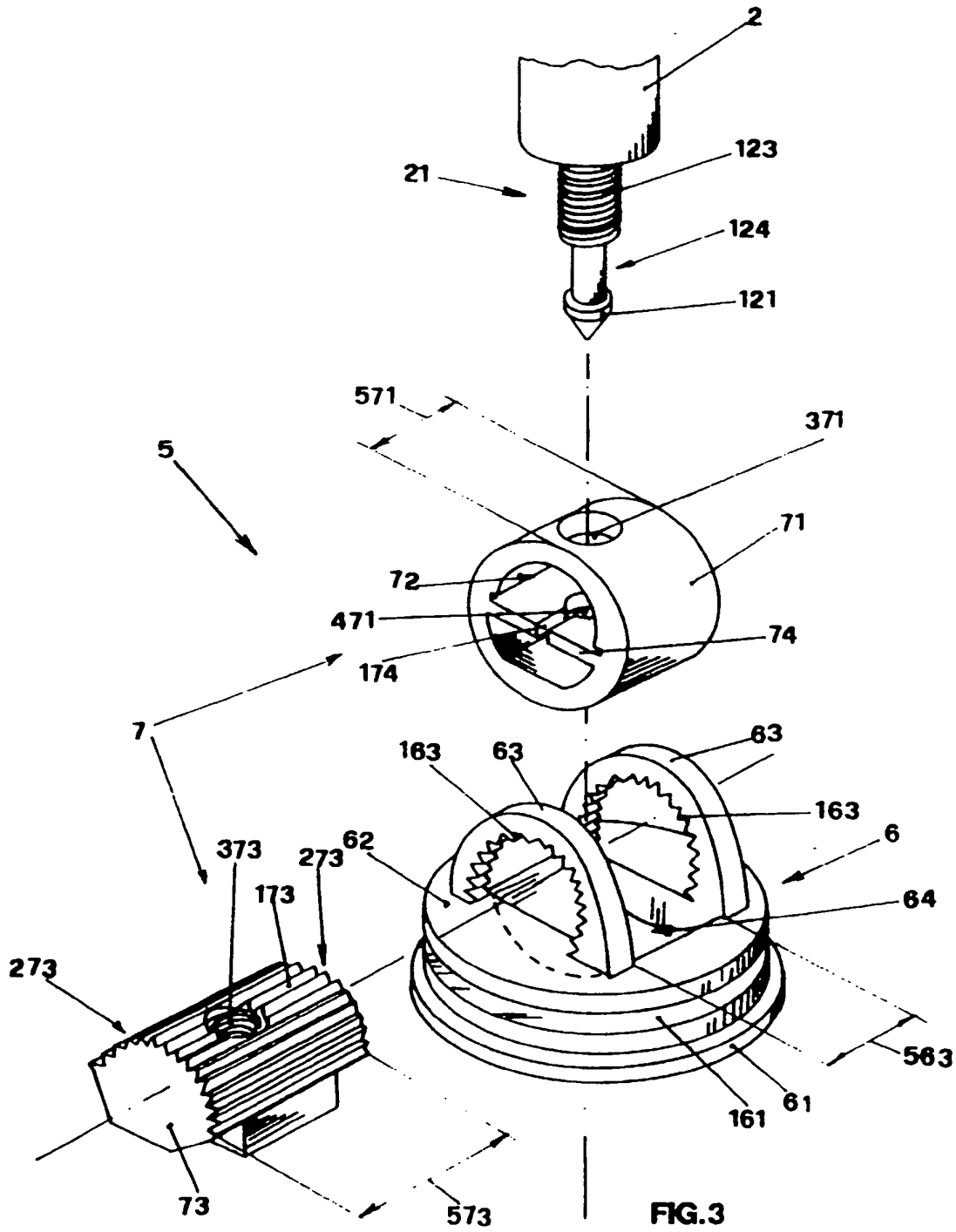
#### Claims 20

1. Antenna (1) comprising a rod (2) suitable for receiving radio-frequency signals and connected to a joint element (5) belonging to a support base (3) of the antenna and also suitable for being constrained to a support surface (4), **characterized in that** said rod (2) is provided with a terminal element (21) unidirectionally insertable in a through hole (471) obtained in an elastic body belonging to said joint element (5). 25 30
2. Antenna (1) according to claim 1), **characterized in that** said body is a plate (17) made elastic by at least one through notch (174) provided in the partition (74) itself and communicating with said through hole (471). 35
3. Antenna (1) according to claim 1), **characterized in that** said terminal element (21) comprises a conical terminal part (121) positioned at the end of a cylindrical area (124) whose diameter is inferior to the diameter of said rod (2), suitable for engaging in said through hole (471). 40
4. Antenna (1) according to claim 3), **characterized in that** said cylindrical area (124) with diameter inferior to the diameter of said rod is connected to the body of said rod (2) by means of a threaded cylindrical area (123). 45 50

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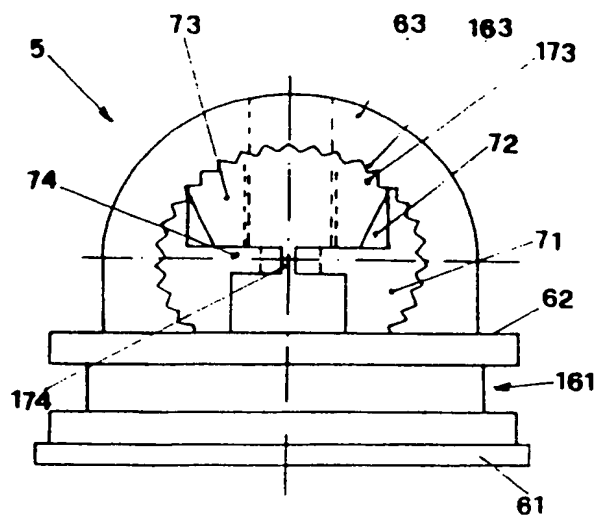


FIG. 4

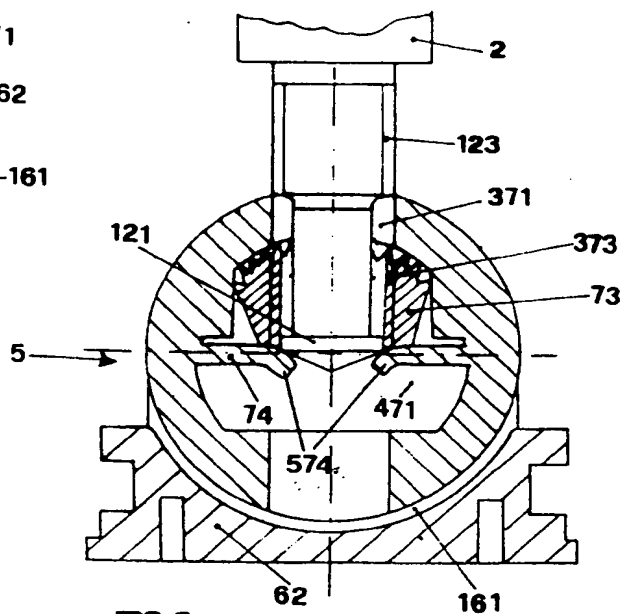


FIG. 5

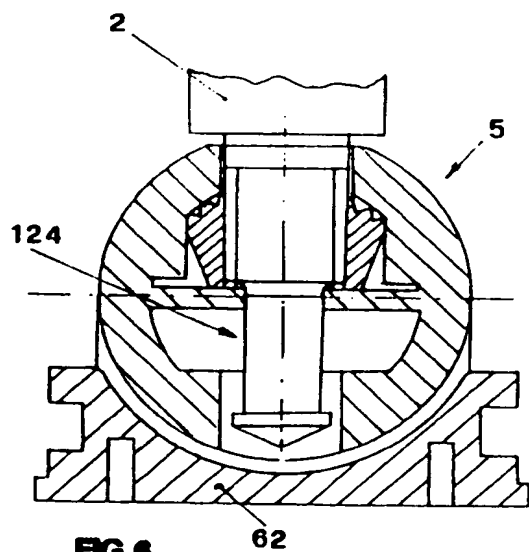


FIG. 6

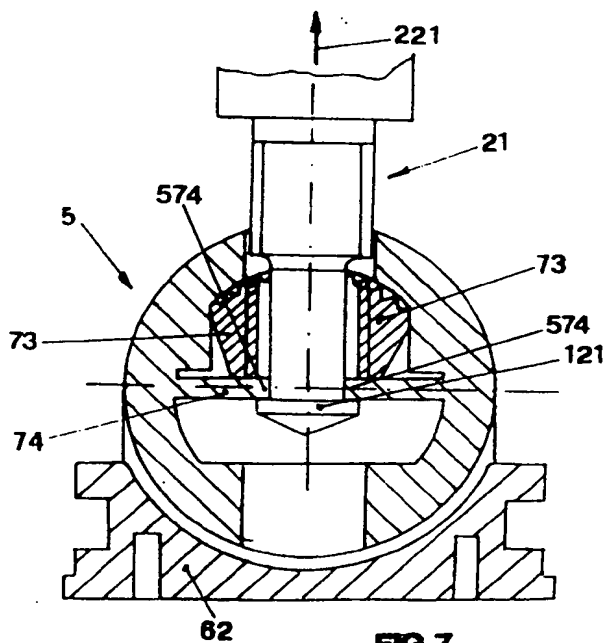
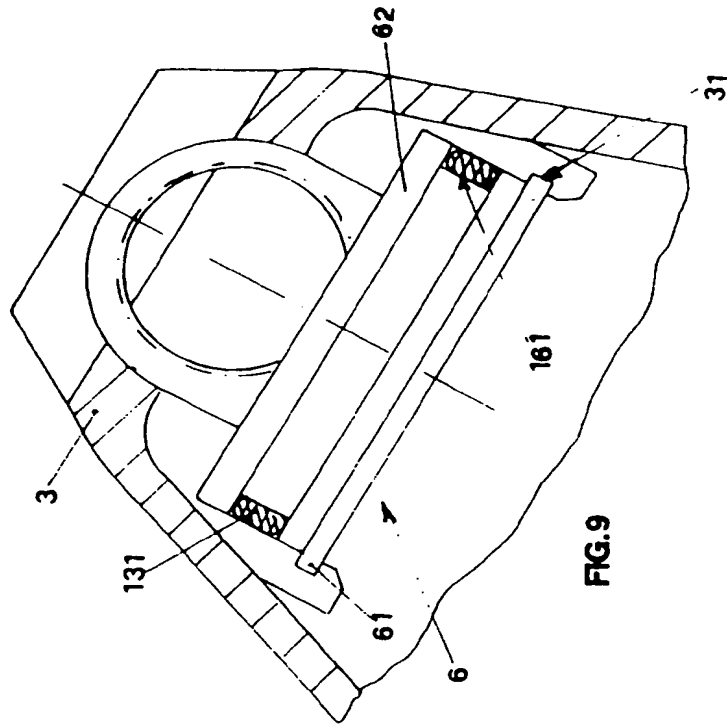
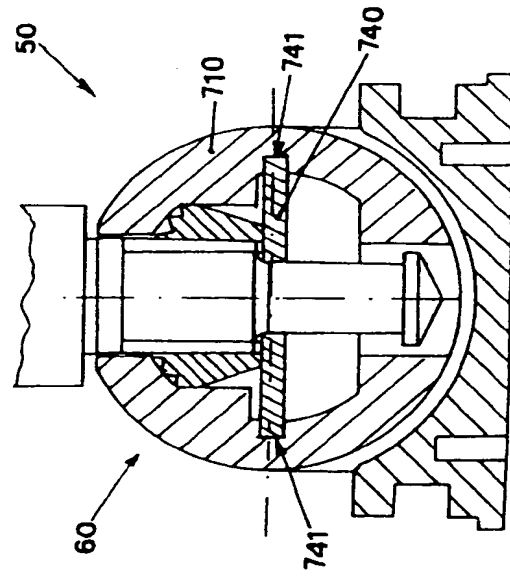
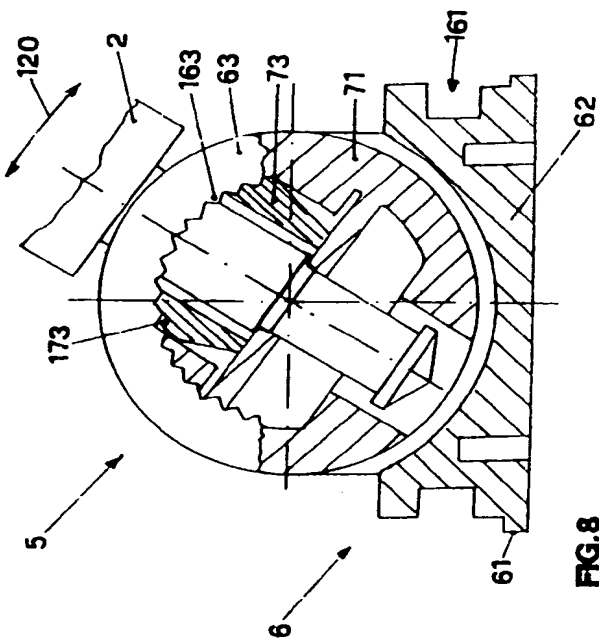


FIG. 7





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# EUROPEAN SEARCH REPORT

Application Number  
EP 98 11 4646

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 27 08 594 A (BOSCH GMBH.) 31 August 1978 * claims 1,2; figures 1-4 *	1	H01Q1/08
A	FR 2 478 379 A (BOSCH GMBH.) 18 September 1981 * claim 1; figure 2 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01Q
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 9 October 1998	Examiner Danielidis, S
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